~~1809~~

EXTRACTS

FROM

(A)

Mr. YOUNG's SIX MONTHS TOUR

K.

THROUGH THE

NORTH OF ENGLAND.

AND FROM THE

LETTER of an unknown AUTHOR, publiſhed
in the LONDON MAGAZINE, for *October*, 1772,
on the Subject of CANAL NAVIGATIONS.

ADDRESSED TO THE

Right Honourable the LORD MAYOR,
ALDERMEN, and COMMON-COUNCIL
of the CITY of LONDON.

BY JAMES SHARP.

MDCCLXXIV.

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TO THE
RIGHT HONOURABLE
The LORD MAYOR,
ALDERMEN, and COMMONS
of the CITY of LONDON.

My Lord, and Gentlemen,

THE following Deſcription of the Duke of *Bridgewater*'s Canal was publiſhed by Mr. *Arthur Young*, in 1769; and the Letter on the ſubject of Canals by an unknown Author in the *London Magazine* for *October* 1772. I have printed theſe Extracts from them, to elucidate and explain more fully, the Subject now under Conſideration; for, I am perſuaded, that a proper Underſtanding of their Utility will make us earneſtly embrace the Opportunity that now offers, of bringing a Navigation to *Moorfields*; this may eaſily be extended to more diſtant parts, and will be an Example of Communication with this great City, which may ſoon be followed by other Channels of the ſame Kind, each of which may be as valuable to *London* as the River *Thames*.

I am,
My Lord, and Gentlemen,
Your moſt obedient and moſt
humble Servant,

Leadenhall-Street,
Feb. 16, 1774.

JAMES SHARP.

An EXTRACT *from* MR. YOUNG's SIX MONTHS TOUR *to the* NORTH *of* ENGLAND. Page 196, &c. Letter XIX.

THE original deſign of the Duke of *Bridgwater*, was to cut a canal from *Worſley*, an eſtate of his Grace's, abounding with coal mines, to *Mancheſter*, for the eaſy conveyance of his coals to ſo conſiderable a market; and, in 1758-9, an Act of Parliament for that purpoſe was obtained. The courſe of the canal preſcribed by this act, was afterwards varied by the ſame authority, and the Duke further enabled greatly to extend his plan; for he now determined, and with uncommon ſpirit, to make his canal branch not only from *Worſley* to *Mancheſter*, but alſo from a part of the canal between both, to *Stockport* and *Liverpool.* The idea was a noble one, and ranks this ſpirited young nobleman with the moſt uſeful genius's of this or any age. But the execution of ſo great a plan teemed with difficulties that required a perpetual exertion of abilities fertile in reſources.

The firſt point in viewing this navigation, is to ſend from *Mancheſter* to *Worſley*, to ſpeak for a boat, to carry your party the whole tour: (By the bye, it is a ſtrange affair, that the town of *Mancheſter* does not poſſeſs a boat for the accommodation of its own inhabitants, and ſtrangers who come to ſee it; for want of one, you may very probably wait a day or two*:) And in the mean

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* This is not to be wondered at, if we conſider that the canal is *private property*, and that none are ſuffered to have

time you may employ yourſelf in viewing the works at *Mancheſter*: This was my plan. And it will not be amiſs if you aſk for Mr. *Mac-ſomething*, —*Mac-lean*, I think, the principal man that delivers the coals: He is a ſenſible, intelligent fellow, and will ſhew and explain every thing there.

The head of the navigation forms two terminations, marked A and B, in the annexed plan, Plate V. Fig. 2. The firſt is, a common wharf for the landing of coals out of large barges, for the ſupply of carts and waggons. The ſecond is a ſubterraneous canal, arched over, into which long but narrow boats enter, being of a conſtruction fitted for a peculiar purpoſe elſewhere. This ſubterraneous paſſage extends from C to D.

At E, in the roof of the arch turned over this water, is a well, bricked like common ones, which is ſunk from the ground above; (*N. B.* It is much higher than the level of the water, being ſomewhat of a hill;) upon which, and near the mouth of this well, is erected a crane of a new conſtruction, which turning upon a pivot, is brought at pleaſure over the well, and draws up the coals. G.

The boats contain a ſyſtem of ſquare boxes, fitted in exactly; theſe are filled with coals (each holds eight hundred weight) at the mine, for the convenience of being eaſily landed through this well; they therefore enter the ſubterraneous canal, and

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have paſſage or pleaſure boats upon it without the conſent of the proprietor—and this points out the inconvenience ariſing from canals becoming the *private property* either of one man or any body of men; though it muſt be allowed that the greateſt civility is ſhewn to ſtrangers upon this canal, and every accommodation afforded, which will no doubt be continued during the lifetime of the preſent noble poſſeſſor.

Vol. III. Pl. 5. page 206.

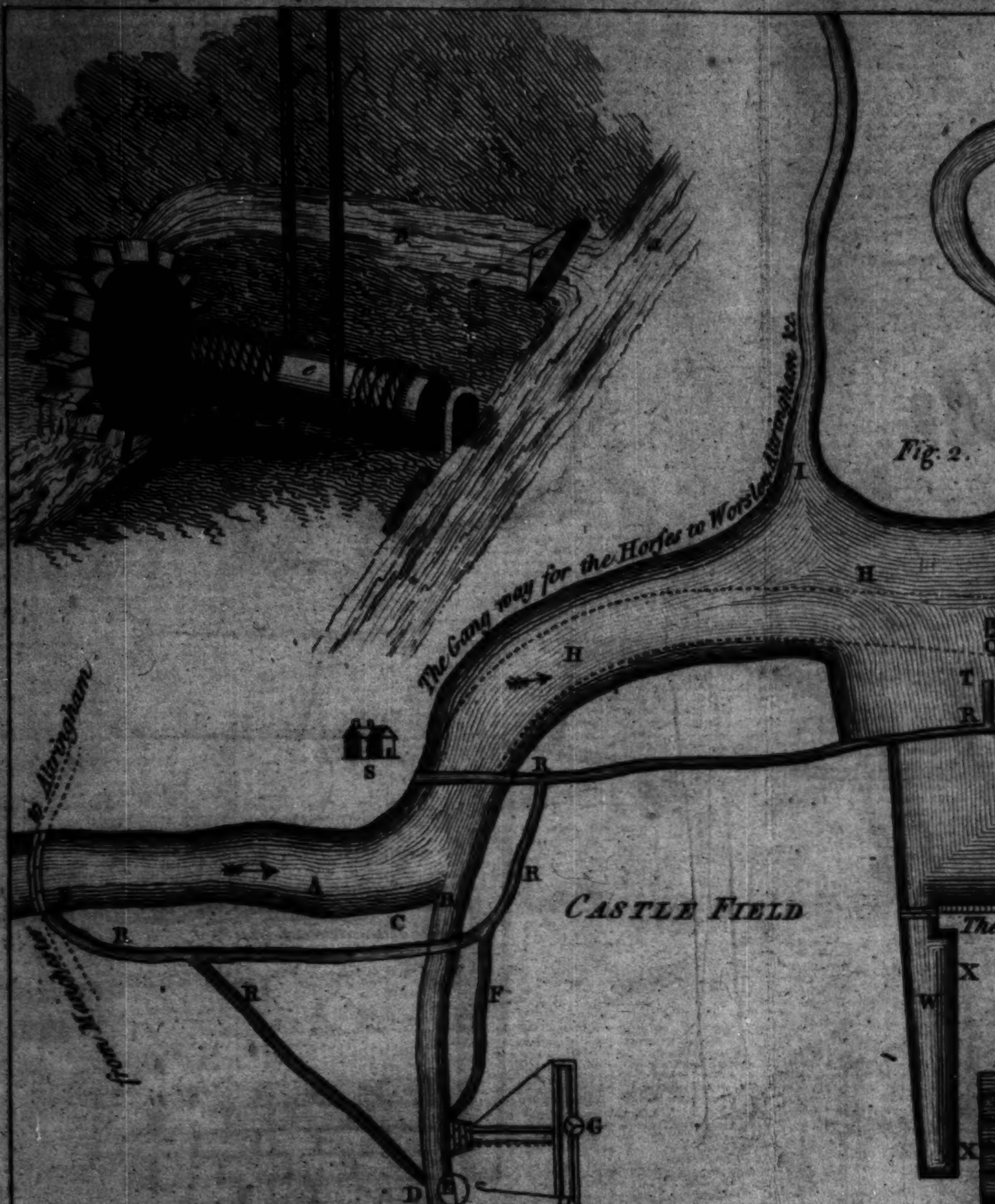
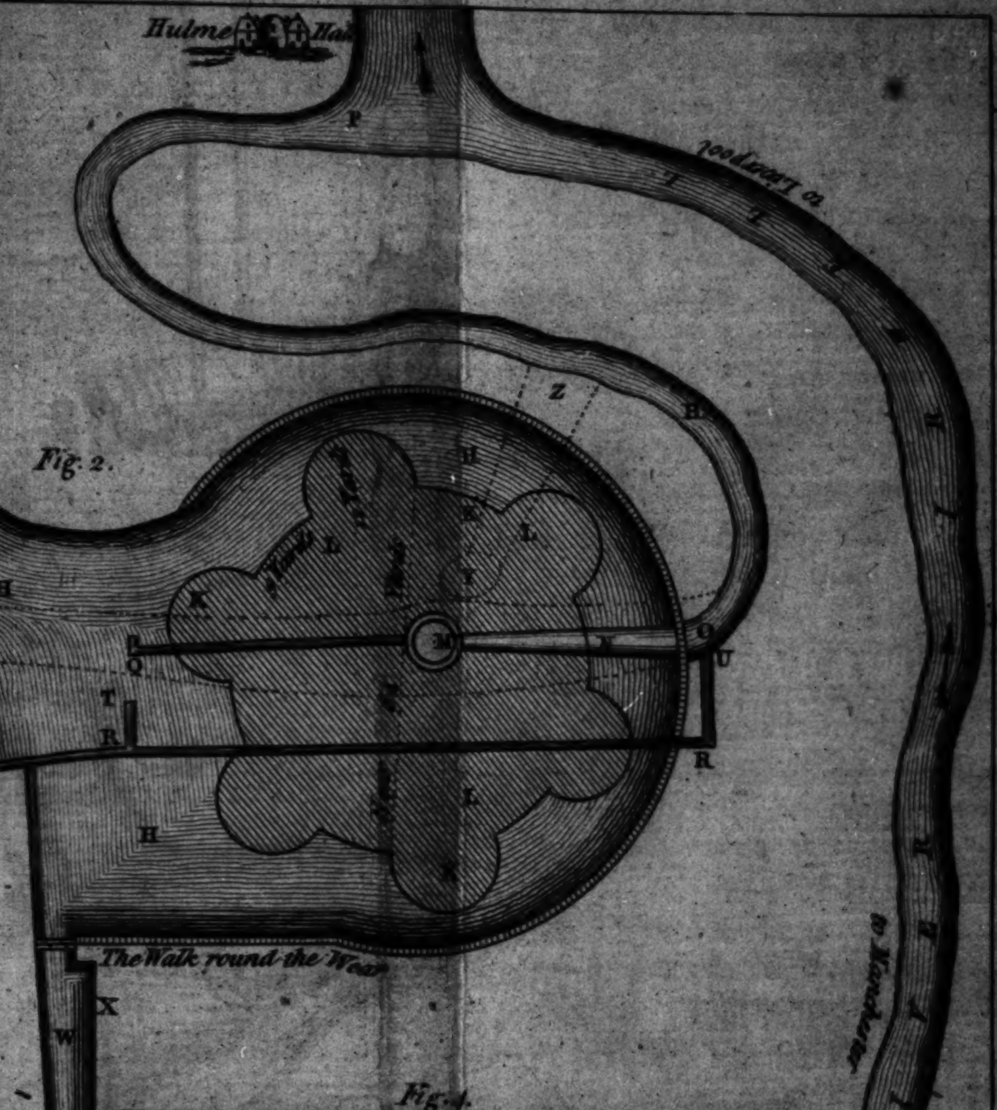


Fig. 2.

Fig. 1.

Fig. 2.


Hulme Hall
P
to Liverpool
Z
H
L
K
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T
R
Q
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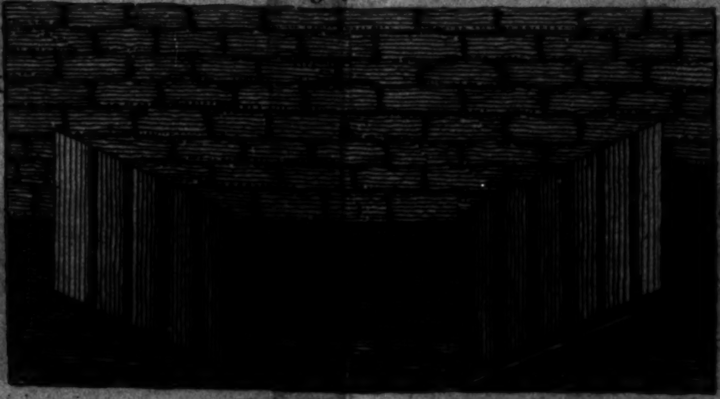
X
The Walk round the Wear
to Manchester

Fig. 1.



and move on, until they come under the well; there they ſtop, and the ropes which are fixed to the crane above, being let down with hooks, at the end are faſtened to the boxes, (which are ironed for that purpoſe) and then drawn up.

The power of this crane is that of a water wheel, contrived in a very ſimple manner. The beſt way of explaining it will be by a little ſketch, Plate V. Fig. 3. But remark, that I only draw this from idea, the cavern in which the wheels work being under ground, and below the ſurface of the ſubterraneous canal; and all the light I had was that of a farthing candle. I offer it only as an explanation, which may give you a better idea of the manner in which the coals are drawn, than a mere deſcription in words.

a. Is the canal arched over.

b. A little branch of it, or rather a trough, into which the water is let at pleaſure by drawing up the ſliding door *c.*

d. A water wheel, into the cavities of which the water falls out of the trough *b.*

e. A wooden cylinder, to which the ropes are faſtened; turned by the above water wheel, which winds the ropes round it.

f f. The ropes which are faſtened at top to the crane.

g. The channel through which the water that turns the wheel, runs off, marked F in the large plan.

Each boat contains twelve boxes; two men and a boy are employed in the unloading, who are from twenty to forty-five minutes about each boat load; this variation is occaſioned by cauſes which will be explained hereafter. When drawn up, the boxes are emptied on a heap for ſale; and then let down again into the boats. This ſubterraneous canal is extended further than the crane, with deſign to erect another upon the ſame principles. At the mouth of it is a door faſtened on hinges at the bottom of the water, which falls or riſes at pleaſure, and when up ſtops the water from entering; a trap-door at the bottom of the ſubterraneous canal, may then be opened, and all the water let out for repairing any of the works; it runs into the channel, *g*.

I ſhould, in the next place, remark, that the water marked H, H, H, H, is the river *Medlock*, and I, the Duke's canal; but as it is the firſt and grand principle of Mr. *Brindley*'s plan, with all artificial navigations, never to let the water of any brook or river intermix with that of the canal, unleſs to ſupply the requiſite quantity; ſome peculiar contrivance was neceſſary to prevent the canal, in this junction with the river, from being affected by its riſing or falling with floods, &c. For this purpoſe, the *wear* was executed, which is minuted in the annexed plan, marked K: It is a hexagon, of three hundred and ſixty-ſix yards circumference.

The old courſe of the *Medlock* is marked out by the lines dotted thus:

Inſtead of permitting it to continue in that courſe, it was enlarged into the ſize it now appears in the plan, the circular end of which is all raiſed on maſonry. The outward line of the wear, K, K, K, regulates the height of the water in the canal; the higher that edge is, the higher is the water. The river *Medlock*, thus enlarged, falls fifteen inches over that edge of maſonry, into a freſh ſurface of water, marked L, L, L; this is likewiſe all raiſed on ſtone-work; near the center of it is a well M of eleven yards diameter, down which the whole river falls ſeveral yards depth. It is received at bottom in a ſubterraneous paſſage, marked N, and flows out at O, where it appears a common river, falling into the *Irwell*, at P.

The ſubterraneous paſſage N, was made of that length, for a very material reaſon; at Q, is a communication between the end of the paſſage and the ſurface of the water above, in the nature of a ſmaller well, but the mouth plugged up; this is made with deſign to clear the paſſage of all mud or rubbiſh that might accumulate in time at the bottom of the well M, by drawing the plug, and letting down a heavy fall of water, to drive out ſuch rubbiſh at the mouth O.

The reaſon why the wear was made of this form, was to command a greater line of extent, within a ſmaller general ſpace than if it was a plain circle, ſquare, or other ſimple form. The circumference is three hundred and ſixty-ſix yards, which was neceſſary for the quantity of water to be carried off; now a circle of that circumference could not be contained within the outward bounds of the enlarged river, and at the ſame time leave ſpace enough for a body of water around it.

The lines in the plan, marked R, R, denote a ſubterraneous paſſage, to drain off all ſuperfluous water at ſome houſes and warehouſes at S, S, and alſo from the abovementioned one at F. At T is a well and plug, as before deſcribed at Q, for the ſame purpoſe of cleanſing the paſſage from mud and rubbiſh. The water thus collected flows into the river *Medlock* at U.

Having taken this view of the works in *Caſtle-field*, we next took poſſeſſion of the pleaſure boat we had before ſpoken for, and ſteered for *Worſley*. The firſt objects we met with, were two wears more at *Cornbroke*, formed on the ſame principles as that in the *Caſtle-field*, ſwallowing up rivulets in central wells,

which

which convey the water in ſubterraneous paſſages under the canal, and permit it to riſe again on the other ſide, and flow on in its uſual courſe.

Paſſing on, the canal runs chiefly along the ſides of natural banks; which courſe was very judiciouſly choſen for the convenience of poſſeſſing not only one bank perfectly firm and ſecure, but plenty of earth ready for making the other. Juſt before we came to *Throſtle-neſt Bridge*, I obſerved a projecting piece of maſonry in the canal, which, on enquiry, I found to be the caſe of a canal door, for I know not what other name to give it *. It is upon the ſame principle as that at the mouth of the ſubterranean paſſage, in which the boats unlade in *Caſtle-field*. The contrivance and deſign of theſe doors are admirable; but as many of them will occur in this tour of the navigation, it will not be improper to explain the conſtruction of them here †.

In the ſketch, Plate IV. Fig. 4. A repreſents one ſide of the channel of the canal, being walled; B, is the floor of it; C, C, are two doors, fixed in the poſition they appear in, and turning on hinges at bottom, *d*, *d*, *d*, *d*. The doors have a freedom of riſing, but cannot fall lower; now, it is obvious from this, that in caſe the bank A, breaks, and the water ruſhes out of the breach, the decreaſe of preſſure on the doors C, C, will raiſe them up at once to *e*, *e*, (where they will be fixed againſt projecting irons made for that purpoſe,) as the water at F, F, will then naturally force them up. The conſequence of which is, the loſing no more than the water contained between the doors; and if the bank ſhould break at F, yet the quantity of water loſt would be but trifling. I have thrown the doors

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* Theſe are now called Stops.

† See *Sharp*'s Addreſs to the Common Council.

doors near one another, for your fully underſtanding the principle on which they are deſigned; but in the canal they are at a diſtance from each other in divers places. The ſtopping the loſs of water is of great conſequence, not only to leſſen the miſchief of the mere loſs, in preventing the navigation going forward, but alſo in leſſening greatly the damage the country would ſuffer from being overflowed; a point of much importance.

Next we come to *Leiceſter Bridge*, (under it another canal door) and paſſing through it, I obſerved, on the left hand, a ſmall waterfall, which is the mouth of a main drain made by the farmer, with ſmaller ones that lead into it, all covered: The excellent effect of which is here ſtrikingly viſible; for the land on that ſide was perfectly dry, but on the other ſide the canal very wet, though not much rain had fallen.

At *Water-Meetings* we paſſed another canal door.

Paſſing the mouth of the canal that leads to *Altringham*, &c. and under *Taylor's Bridge*, you catch a view of *Mars Bridge*, in a pretty ſituation, the ſurrounding country fine; you look over it, ſcattered with ſeats, houſes, *&c.* in a pleaſing manner. This part of the canal runs through *Trafford Moſs*, which is a peat earth black moor: It is great pity that the noble advantage of a water-carriage through the heart of this moor, to ſo fine a market as *Mancheſter*, does not induce the owners to cultivate this waſte track, which might, beyond all doubt, be applied to numerous uſes, far more profitable than yielding peat in a country ſo abounding with coals.

The next object that preſents itſelf, is the work at *Barton Bridge*, which is one of the principal undertakings in the whole navigation, and a wondrous one it certainly is. The canal is here, in its uſual breadth, carried (*Roman* aqueduct like) on arches, over the large and navigable river *Irwell*.

The aqueduct is two hundred yards long, and thirty-ſix feet wide; it croſſes the *Irwell* on three large arches, the centre of which ſpans ſixty-three feet; and is carried, with amazing labour, through a valley, filled up to receive it. The view, Plate VII. which I took, ſtanding on *Barton Bridge*, will better explain this ſurprizing work.

A. Is the river *Irwell*.

B. A lock-gate, through which the barges are let that navigate the river, on account of the obſtruction of the caſcade, C.

D.D. A gang-way from one ſide to the other.

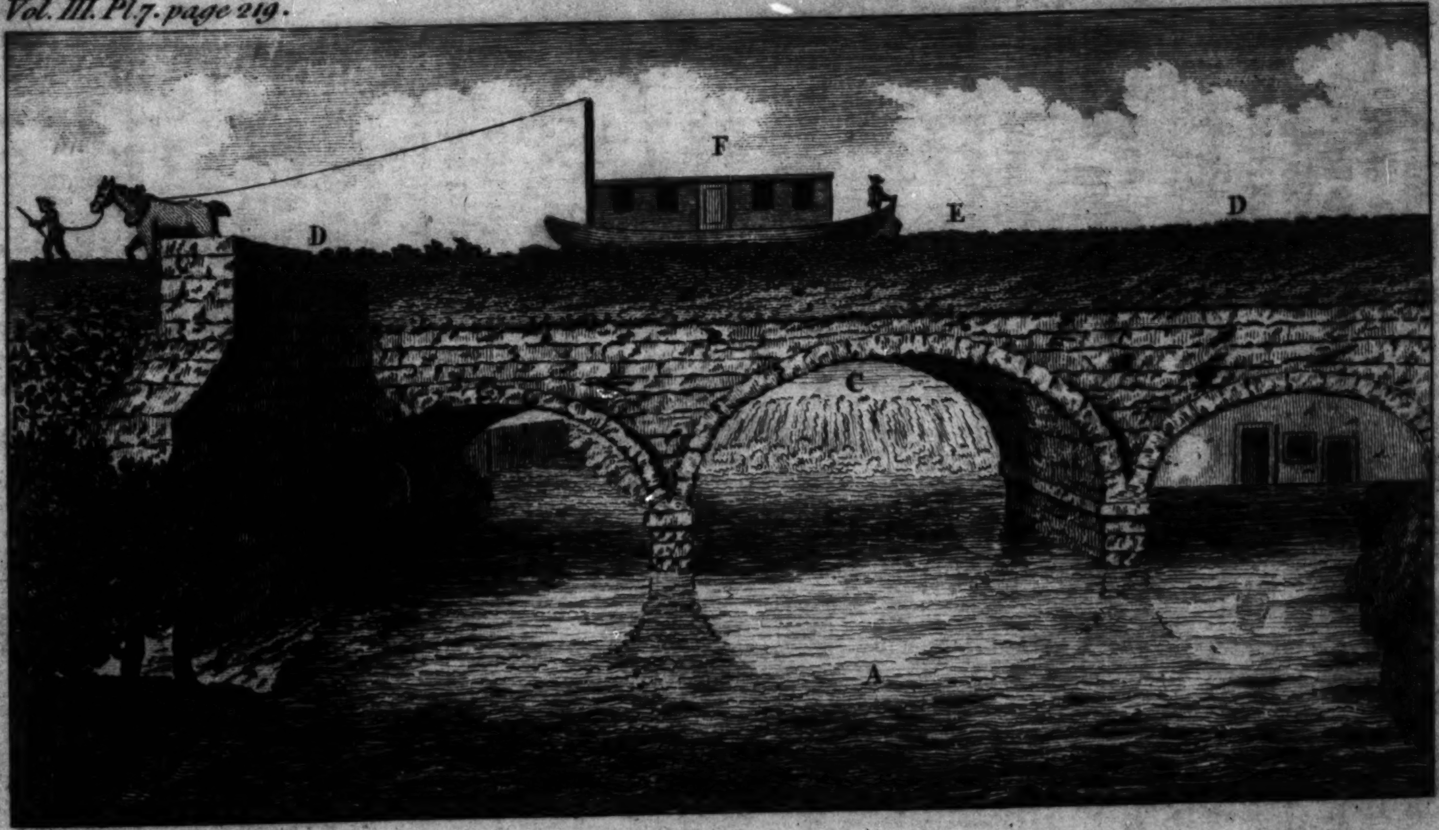
E. The canal.

F. The pleaſure-boat drawn by one horſe.

The effect of coming at once on to *Barton Bridge*, and looking *down* upon a large river, with barges of great burthen towing along it; and *up* to another river, hung in the air, with barges ſailing upon it, form altogether a ſcenery ſomewhat like enchantment, and exhibit at once a view that muſt give you an idea of prodigious labour; for the canal is here not only carried over the *Irwell*, but likewiſe acroſs a large valley, being banked up on each ſide in a ſurprizing manner, to form a mound for the water, and the channel alſo filled up to the uſual depth, that the banks, at a place where they are entirely artificial, and conſequently weaker than where natural, might not be endangered by the great preſſure of ſo large a body of water as the depth here filled up would have contained: And I ſhould remark, that it is a maxim throughout this whole navigation, to keep the canal every where of an equal depth. I believe it ſcarce ever varies above ſix inches; from four feet, to four feet ſix inches.

The

Vol. III. Pl. 7. page 219.



The method Mr. *Brindley* takes to fill up a channel, where too deep, is a moſt admirable one: He builds two very long boats, fixes them within two feet of each other, and then erects upon them a triangular trough, large enough to contain ſeventeen tons of earth: the bottom of this trough is a line of trap-doors, which, upon drawing a pin, fly open at once, and diſcharge the whole burthen in an inſtant. Theſe boats are filled any where from the banks where the earth is in ſuperfluous quantities, by wheelbarrowing in on a plank, laid from the ſhore, on to the trough; the boat is then drawn over the ſpot which is to be filled up, and the earth there dropped: it is aſtoniſhing what a vaſt ſaving is made by this invention: In common management to conduct a canal *level* acroſs a valley, and without locks, would conſume the revenue of a whole county; but ſuch inventions as theſe eaſe the expence at leaſt 5000 *l. per cent.* The following ſketch, Plate VIII. Fig. 1. will give a clearer idea of theſe boat-waggons.

A. The boat that appears on a ſide view.
B. The trough, ſupported by the pieces C, C. C.
D. The ends of the boats.
E. That of the trough.

I ſhould tell you, that any part of this aqueduct can be repaired without damaging the reſt of the canal, or loſing more water than is contained within a ſmall ſpace on each ſide the part decayed; for ſeveral doors, of the ſame nature as thoſe already deſcribed, are fixed in the channel; and alſo trap-doors, or tubes, (if I may ſo call them) at the bottom, *&c.* of the aqueduct, through which, by drawing a few plugs, the water would preſently be diſcharged into the *Irwell*, and the part to be repaired, laid dry at once; a contrivance, which is undoubtedly of vaſt conſequence.

But there are other works at *Barton* which claim our attention, beſides the croſſing the river. Two roads here came athwart the navigation, and happening in this valley, where the canal is ſo much higher than the level of the country, to have built bridges would have coſt immenſe ſums, as the riſe would have required them half as long as that at *Weſtminſter*. The method, therefore, taken by Mr. *Brindley*, was to ſink the road gradually on both ſides, and turning a large arch, to carry the canal over the roads as well as the river: and this is practiſed with both. So that in going under it you ſink gradually on one ſide, and riſe in the ſame manner on the other. The view, Pl. VIII. will explain it clearly.

A. Is the canal.

B. The wall that ſupports the arch.

C. The road.

Leaving this ſcene of wonders, we paſſed on, and coming to *Moreton Bridge*, we preſently ſaw a freſh inſtance of attention, to keep the water of the canal unmixed by that even of the ſmalleſt ſtream, for here an arch is turned under the canal, for a little brook to run through.

A little further another brook is carried under the canal, by means of an arch turned for that purpoſe.

Next we came to one of the ſpots where the lime was found, which proved ſo noble an acquiſition to the Duke. In carrying on the navigation, a vaſt quantity of maſonry was neceſſary, in building aqueducts, bridges, warehouſes, wharfs, *&c. &c.* and the want of lime was felt ſeverely; the ſearch that was made for materials to attempt to burn into lime, was a long time fruitleſs; at laſt Mr. *Brindley* met with a ſubſtance of a chalky kind, which, like the reſt, he tryed; but found (though it was of a limeſtone nature) that, for

want

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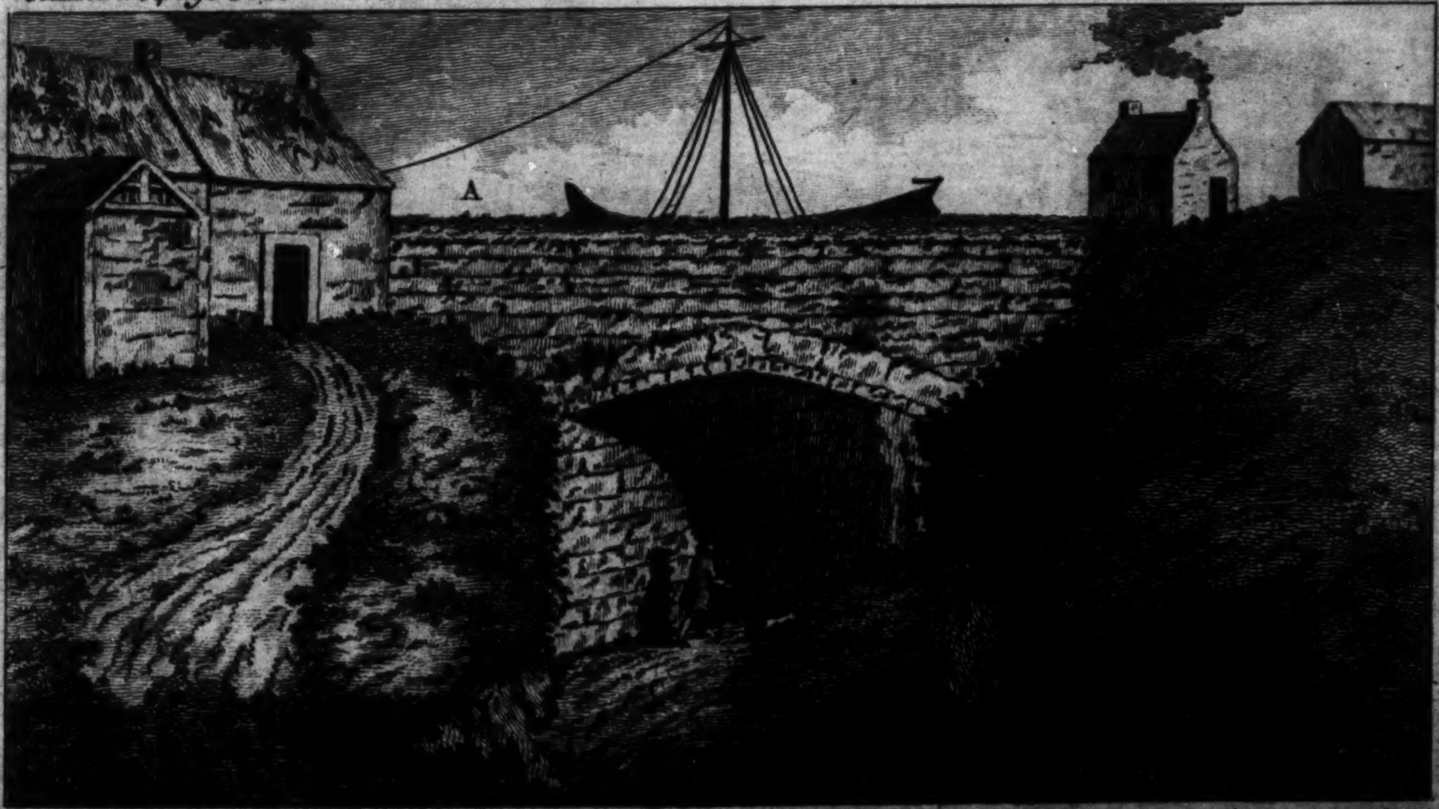

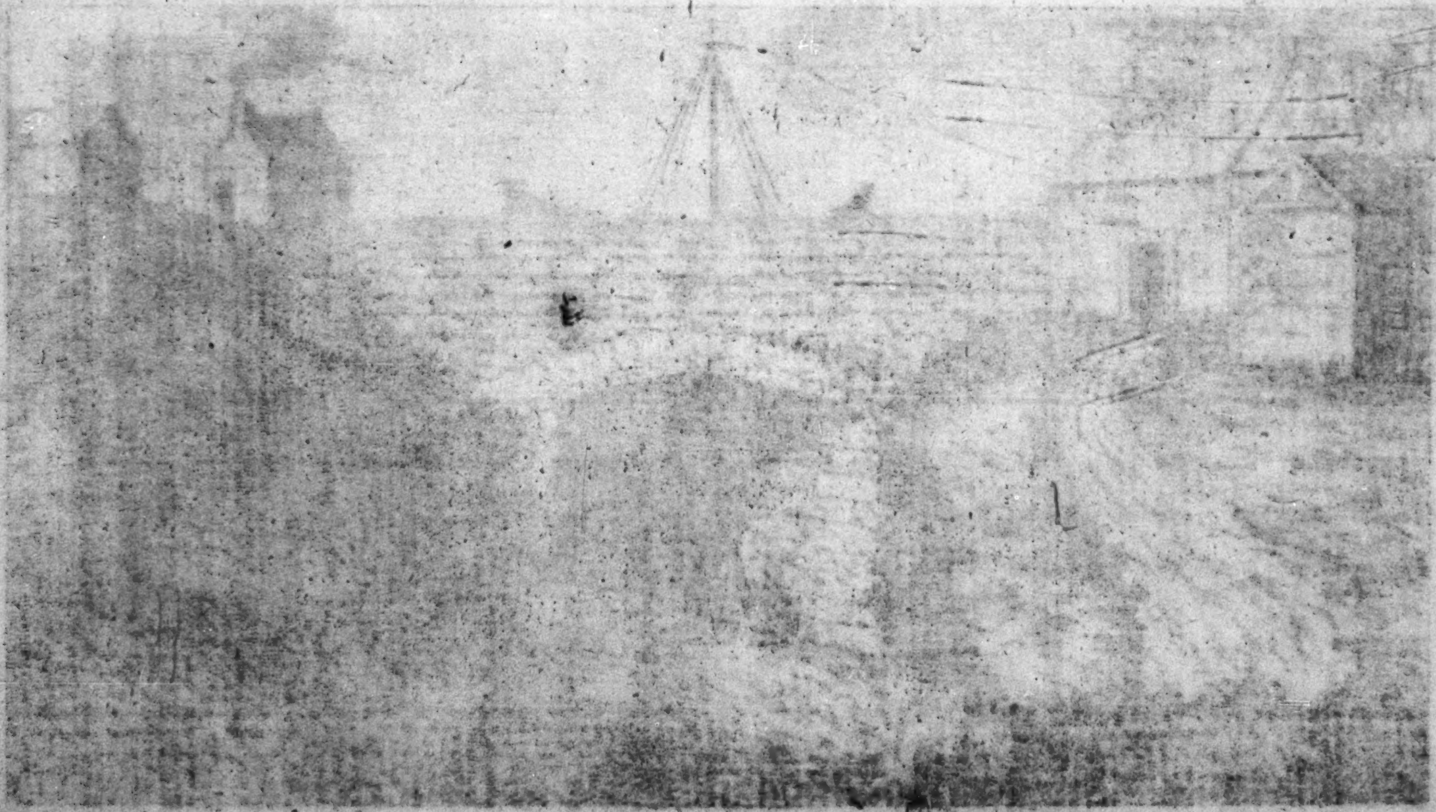

want of adheſion in the parts, it would not make lime. This moſt inventive genius happily fell upon an expedient to remedy this misfortune. He thought of tempering the earth in the nature of brick earth, caſting it in moulds like bricks, and then burning it; and the ſucceſs was anſwerable to his wiſhes: In that ſtate it burnt readily into excellent lime; and this acquiſition was one of the moſt important that could have been made. I have heard it aſſerted more than once, that this ſtroke was better than twenty thouſand pounds in the Duke's pocket; but like moſt common aſſertions of the ſame kind, it is probably an exaggeration. However, whether the diſcovery was worth five, ten, or twenty thouſand, it certainly was of noble uſe, and forwarded all the works in an extraordinary manner. The bed of this lime-marle (which I think is the propereſt name for it) lies on the ſides of the canal, about a foot below the ſurface.

Advancing towards *Worſley*, I was much pleaſed to ſee many vaſt heaps of the mud that came out of the canal, mixed up with dung, and ready to lay on to the grounds. The Duke keeps theſe fields in his own hands, and manages them like an excellent huſbandman.

At *Worſley* we paſſed three more canal-doors, and a large ſtream, which runs under the navigation.

Arriving at the head of the works, we were much ſtruck with the excellent and ſpirited appearance of active buſineſs; for the little village of *Worſley* looks like a river environ of *London*. Here is a very large timber-yard, well ſtowed with all ſorts of wood and timbers for framing buildings, and building boats, barges, and all kinds of floating machines. The boat-builder's yard joins, and ſeveral boats, barges, &c. are always on the ſtocks.

Next to theſe is the ſtone maſon's yard, where lie vaſt piles of ſtones, ready ſquared, for loading barges with, to convey to any part of the navigation where they may be wanted, either for building, or repairing of bridges, aqueducts, wharfs, warehouſes, &c. the quarry is juſt by the mouth of the mine, and much is brought out of the mine itſelf, in working for the coals. Thus every part of the whole deſign acts in concert, and yields mutual aſſiſtance, which is the grand art of œconomical management.

The great curioſity at *Worſley* is the tunnel, which is a ſubterraneous canal hewn out of the rock to a great length (near a mile,) and extends into the heart of the coal mines. The view, Plate VII. exhibits the mouth of it, and likewiſe the quarry works around it.

A. The navigation.

B. The mouth of the tunnel, with large doors to open and ſhut.

C. The Quarry.

D. A crane of a very curious conſtruction, for heaving the ſtones out of the quarry into the barges *.

E. Ropes that keep the crane in its perpendicular poſition.

The water in the tunnel is upon the level of that in the canal, being the ſame, ſo that the boats loaded with coals come out of the very mine itſelf.

The firſt entrance, for one thouſand yards, is ſix feet and a half wide, and ſeven feet and an half high, including the water, which is three feet four inches deep; it is already continued ſeven hundred and fifty yards further, ten feet wide, and it is ſaid (how true I know not) that it will be carried on at

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* A Crane of this kind may be ſeen at Mr. *Sharp*'s Iron manufactory in *Tooley-Street*, *Southwark*.

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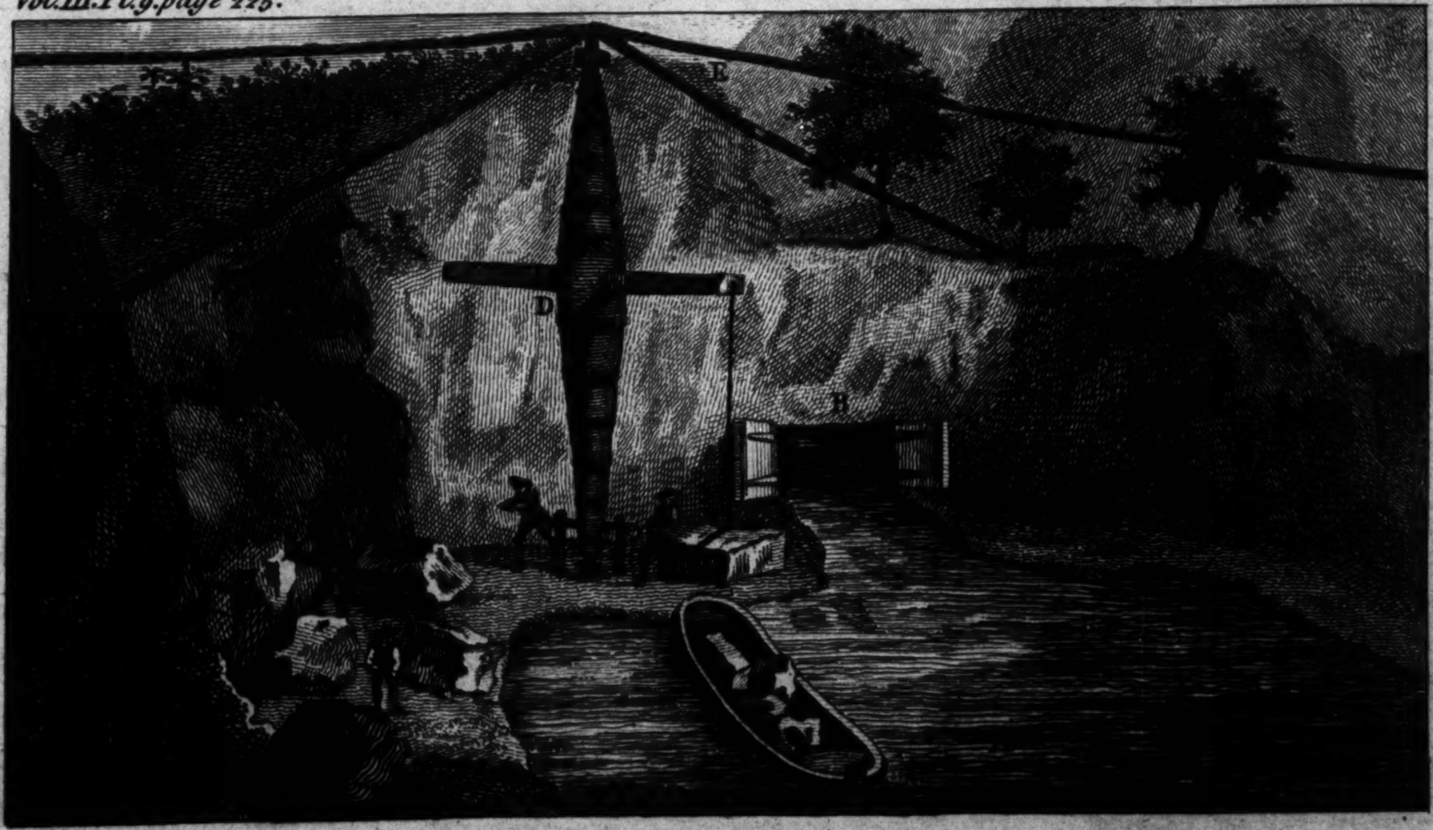
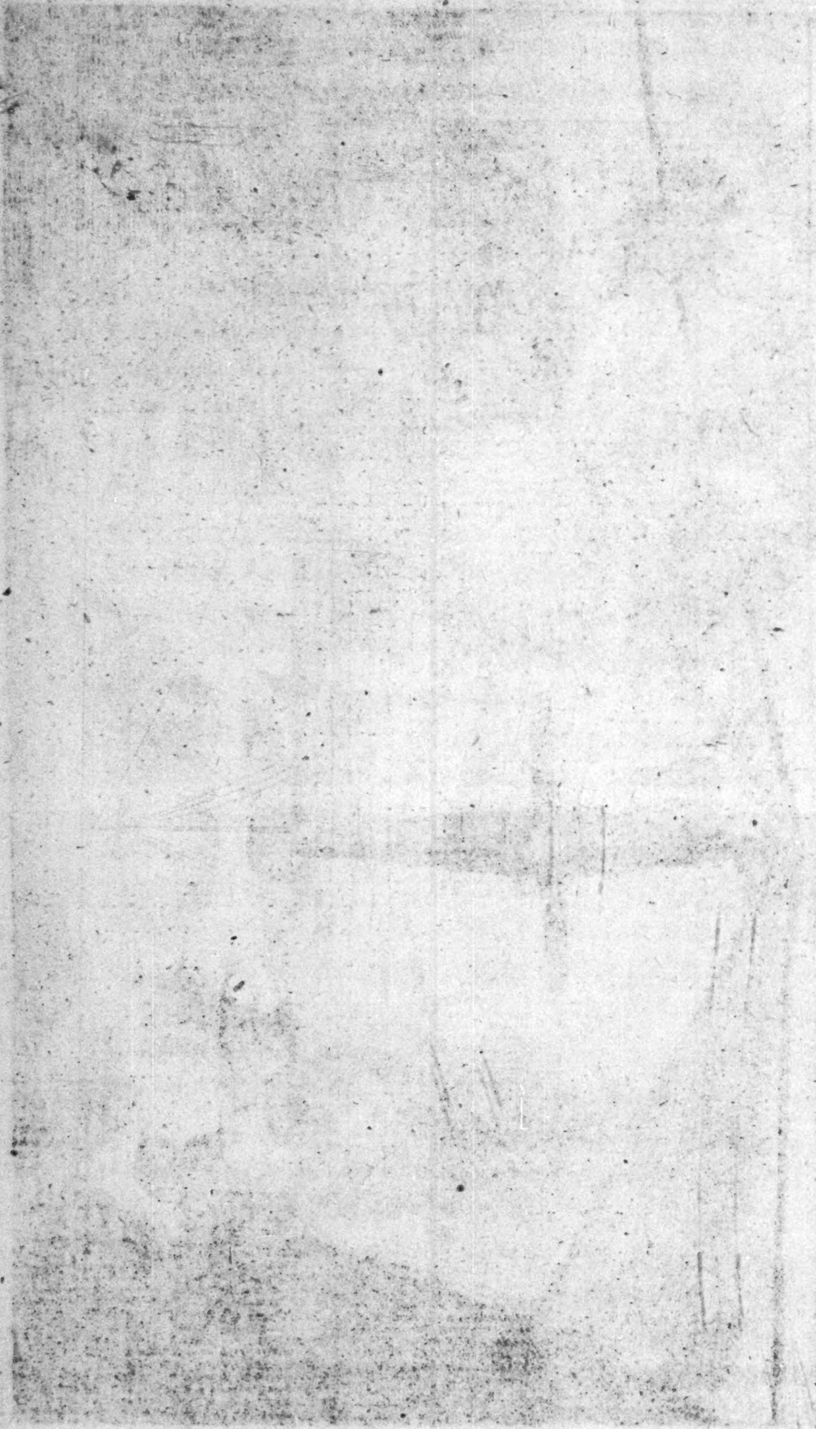
Vol.III.Pl.9.page 225.





leaſt a mile and a half further. I took ſome time to explore the horrid caverns of theſe mines, and found, on an attentive examination, that the method of conducting the buſineſs of them, was nearly as follows:

The ſeams (or, in theſe mines, rather veins) of coal branch divers ways, ſome are above the tunnel, and ſome below it; as faſt as the coal is got, the ſpace is cleared and arched for a road, to move the coal on: This is done in little four-wheeled waggons, which contain ten *cwt.* of coals, and are puſhed along by a man ſetting his head and hands againſt them, (the road being laid on purpoſe for it.) The roads all lead to the tunnel. When the man with the waggon comes over a well (of which there are ſeveral) that is ſunk from the road through the arch of the tunnel, and under which the boats are fixed, he ſtops on a frame work of wood, which turns on pivots, and is ſo contrived, that upon drawing up a part of one end of the waggon, ſome of the coals drop out, and then the waggon is tilted up, and all the reſt follow them, falling into the boat beneath either promiſcuouſly, or directed through a tube to fill a box at a time, at pleaſure, which work is performed almoſt inſtantaneouſly, and the waggon ſent off again for a freſh cargo.

But as the arches (roads) through the mine in many places croſs each other, it would there have been impracticable for a man to puſh ſo great a weight around a turning; to remove which objection, the ſquare of the floor in the croſs of the roads is all of wood, and turns upon a central pivot of iron, ſo that the man ſtopping when the waggon comes exactly on to the ſquare, and turning it till it faces the road he is to go, he then puſhes on without the leaſt interruption.

The coals that ariſe in the branches of the mine *below* the tunnel are drawn up through wells into thoſe *above* it, and then conveyed, like the reſt, in waggons to the boats.

When they are loaded they are linked together in a gang; and for the convenience of drawing them out, there is a rail on each ſide the tunnel, for the perſon who ſtands in the firſt boat to hold with his hands and draw himſelf along; which gives him ſo great a power, that a boy of ſeventeen has drawn out a gang of twenty-one boats loaded, which, at ſeven tons each, is an hundred and forty-ſeven tons. But this is only one inſtance, and out of the common courſe of buſineſs; they commonly bring out a gang at a time, which is four or ſix, and as ſoon as they are out of the tunnel, they are drawn by mules to *Mancheſter*, *&c.*

The tunnel, where it paſſes through earth or coal, is ſurrounded with brick-work, but through the rock it is only hewn out.

At the diſtance of about a thouſand yards from the mouth, it divides into two, which branch different ways, for the convenience of loading coals in the above compendious manner in every part of the mine; and more branches are in contemplation: It has been aſſerted, that thoſe who go up both paſſages travel therein three miles; but this is an exaggeration.

Every here and there along the tunnel are wells, bricked from it to the top of the hill, for the admiſſion of air, the exhalation of damps, and the letting down men for reparations in caſe of accidents.

I have read of tin tubes for the conveyance of air into this mine, but there is no ſuch thing; the ſhafts, paſſages, and tunnel ſupply it ſufficiently.

As there generally is much ſuperfluous water in coal mines, it was a very beneficial ſcheme to cut this tunnel for draining that water away, and, at the

the ſame time, for carrying the navigation into the heart of the colliery: Such bold and deciſive ſtrokes are the fineſt proofs of inventive genius, of that penetration which ſees into futurity, and prevents obſtructions unthought of by the vulgar mind, merely by foreſeeing them: A man with ſuch ideas moves in a ſphere that is to the reſt of the world imaginary, or at beſt a *terra incognita.*

The beſt way of viewing the extent of the mines, is by going down the ſhaft and coming out by the tunnel; and ſometimes you muſt either take this method, (which was my own caſe,) or not ſee it at all; for boats are not always going in, nor to be had for that purpoſe; but you will ſeldom fail of an empty boat within, by which your guide, (the oſtler, I think, of the inn,) will convey you out.

Near the head of the canal is another curioſity, very well worth viewing. It is a mill of a new conſtruction, with many powers. The firſt motion is the turning a wheel, twenty-four feet diameter, by a ſmall overſhot ſtream. This wheel works three pair of grinding-ſtones for corn, a boulting mill, which diſcharges the meal divided into three ſorts of flour, beſides the ſeparation of the pollard and bran; and theſe works are effected with hogs briſtles, fixed within the wire ſieves. It likewiſe turns a machine for making mortar, which is done by being laid upon a horizontal ſtone, worked by a cogged wheel beneath it; and the horizontal ſtone turns two others that are fixed obliquely, and work by their friction the mortar under them, which is taken off as made by a man who is ready for the purpoſe.

This little ſtream further turns another machine, of excellent uſe: It is for ſifting the ſand uſed in the buildings, and waſhing out the little ſtones that are in it; which it performs very effectually and expedi-

expeditiouſly. The ſketch, Plate X. Fig. 2. will explain the mechaniſm.

a. Is the tube from which the water iſſues.

b, The hopper, in which the ſand is thrown out of wheel-barrows.

c, Is a wier cylindrical ſieve, into which the ſand falls from the hopper, and which, being turned by the large wheel, ſifts the ſand which drops through the wiers into the wheel *f*, and out of that, after a freſh operation, into the trough *g*, from whence it is taken in ſhovels.

d. Is a trough for conducting the ſtones driven by the water out of the end of the cylinder, into a wheel-barrow *e*, placed to receive them.

b, Is a board, leaned aſlant upon the frame-work of the machine, for the men to drive up the wheel-barrows on.

The navigation is carried a mile and half beyond *Worſley*, into the middle of a large bog, called here a moſs, belonging to the Duke, and merely for the uſe of draining it, and conveying manures to improve it: It is greatly to that nobleman's honour to find him attending, and at a conſiderable expence, to matters of huſbandry, in the midſt of undertakings that would alone convey his name with peculiar brilliancy to the lateſt poſterity.

This bog is of large extent, extremely wet, and ſo rotten, that, before it is improved, it will not bear even a man. The Duke begins by cutting ſmall drains, very near each other, which ſoon render the ſurface pretty firm. Then his barges bring the chippings of ſtone, and other rubbiſh, which ariſe in digging the coals, and which are brought out of the mine exactly in the ſame manner, only inſtead of going to market, to be ſold, they are converted into money, in another way, by being brought hither. This rubbiſh is wheel-barrowed out of the barges on boards, on to the land,

which

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Fig.1.

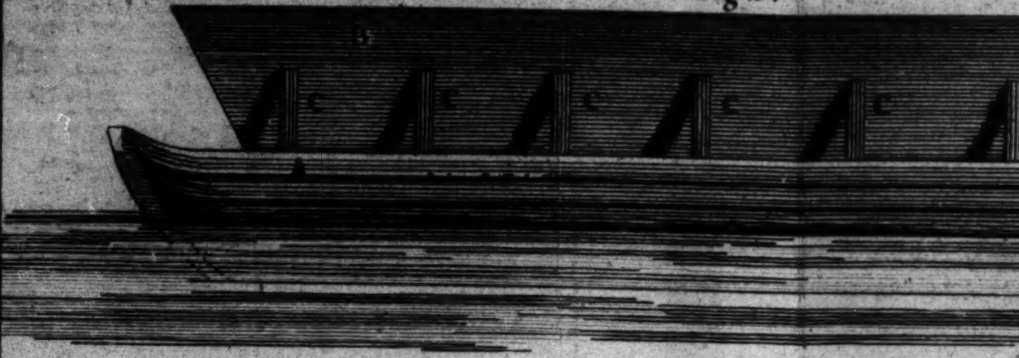
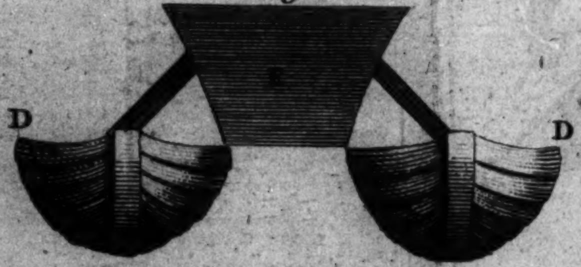
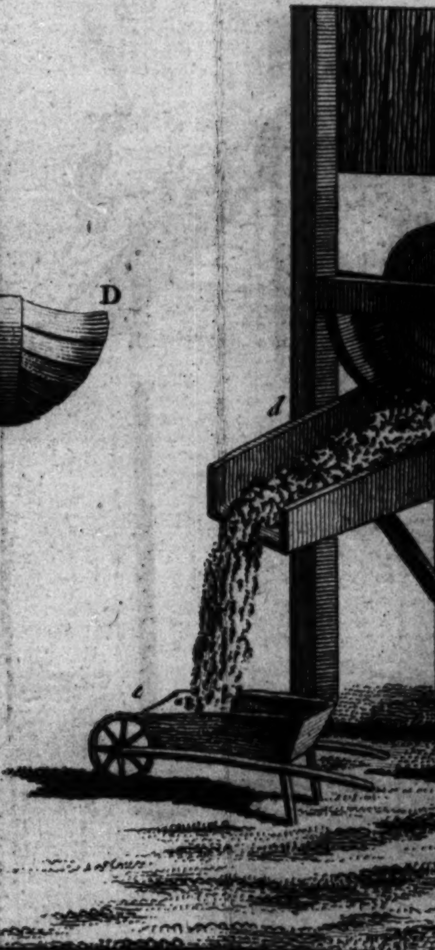


Fig.1.





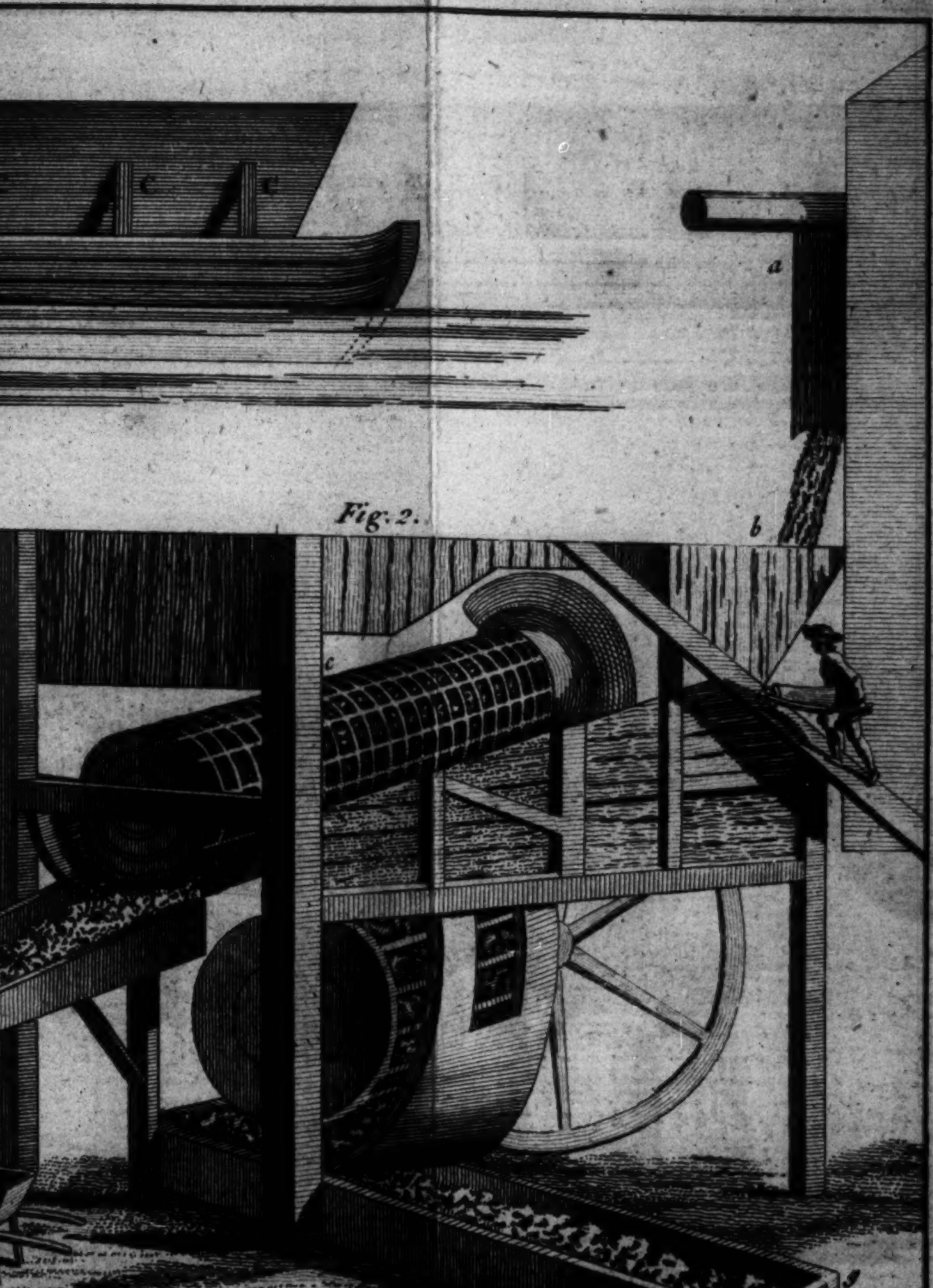


Fig. 2.

which is greatly improved by it; the ſurface ſoon becomes ſound, the aquatic ſpontaneous growth diſappears by degrees, better herbage comes, and thus it is converted into profitable paſture, without any paring, burning, or ploughing. Some of the larger ſhivers of the ſtone will not crumble with the froſts; ſuch are picked up, laid in heaps, and carried back to the ſtone-yard, where they are ſquared for buildings, or converted to other uſes.

As faſt as the bog becomes improved, the canal is extended, for the ſake of going on with the work; and almoſt at the end of it, his Grace is building a ſmall houſe, for an overſeer, ſituated upon land which once would not have borne even the men employed now in building on it.

This improvement is of a new kind, and peculiarly uſeful in the neighbourhood of quarries, ſtone-maſons yards, mines in rocks, *&c.* *&c.*. In this inſtance it is of noble advantage, for the rubbiſh would be troubleſome at *Worſley*, and expenſive to carry out of the way; ſo that this improvement muſt be conſidered as another *part* of this grand WHOLE, which is ſo admirably connected, and, by itſelf, ſo aſtoniſhingly ſupported.

At *Worſley* land lets from 20 *s.* to 3 *l.* *per* acre. Farms riſe from 20 *l.* to 100 *l.* a year.

The next buſineſs is to view the other branch of the canal, which extends to *Altringham*, *&c.* and for this purpoſe you return to *Mancheſter* to lie, and keep the pleaſure-boat, to be ready at *Caſtlefield* the next morning.

After arriving in the old courſe at the branching off, you firſt come to *Longford-bridge*, under which is a canal-door. And juſt by a ſmall circular wear, for the conveyance of a ſtream under the canal, the brook falls into the well, in the nave of the circle, down to an arched paſſage, which conveys

it

it under, and lets it riſe again in its old courſe on the other ſide.

At *Waterford* the canal extends acroſs a long valley, the level being preſerved without locks: The work is here very noble: The banks of earth of a vaſt height and thickneſs, beautifully ſloped, and the whole appearance ſtrikingly great. It here croſſes at the ſame time a large brook much ſubject to floods, and a road: Two arches carry it over the ſtream, and a third over the road. The view, Plate XI. will better explain it.

A. The ſtream.
B. The wall of the aqueduct.
C. The road.
D. The ſloped green bank of the canal.
E. A meadow.

The three arches extend eighty feet. Here are trap-doors, *&c.* as at *Barton-Bridge*, for ſecuring the water of the canal in caſe of a breach, or for reparations.

Further in the ſame valley the navigation is carried acroſs the river *Merſey*, on one arch of ſeventy feet ſpan.

I ſhould remark, that the canal acroſs this whole valley is of a vaſt breadth, and has rather the appearance of a great navigable river, than an artificial canal cut at the expence of a ſingle perſon.

Next it is carried acroſs *Sale Moor*; under the firſt bridge you catch a pleaſing view, through the arches of other bridges, in a line, and at the end, a church and ſteeple. This part of the navigation, from the lowneſs of the *Moor* below the level of the canal, was pronounced by many to be impracticable, and Mr. *Brindley's ne plus ultra*; but this difficulty was removed by perſeverance and ſpirit; a complete bed was made for the canal, raiſed at bottom as well as the ſides, ſufficient for conduct-

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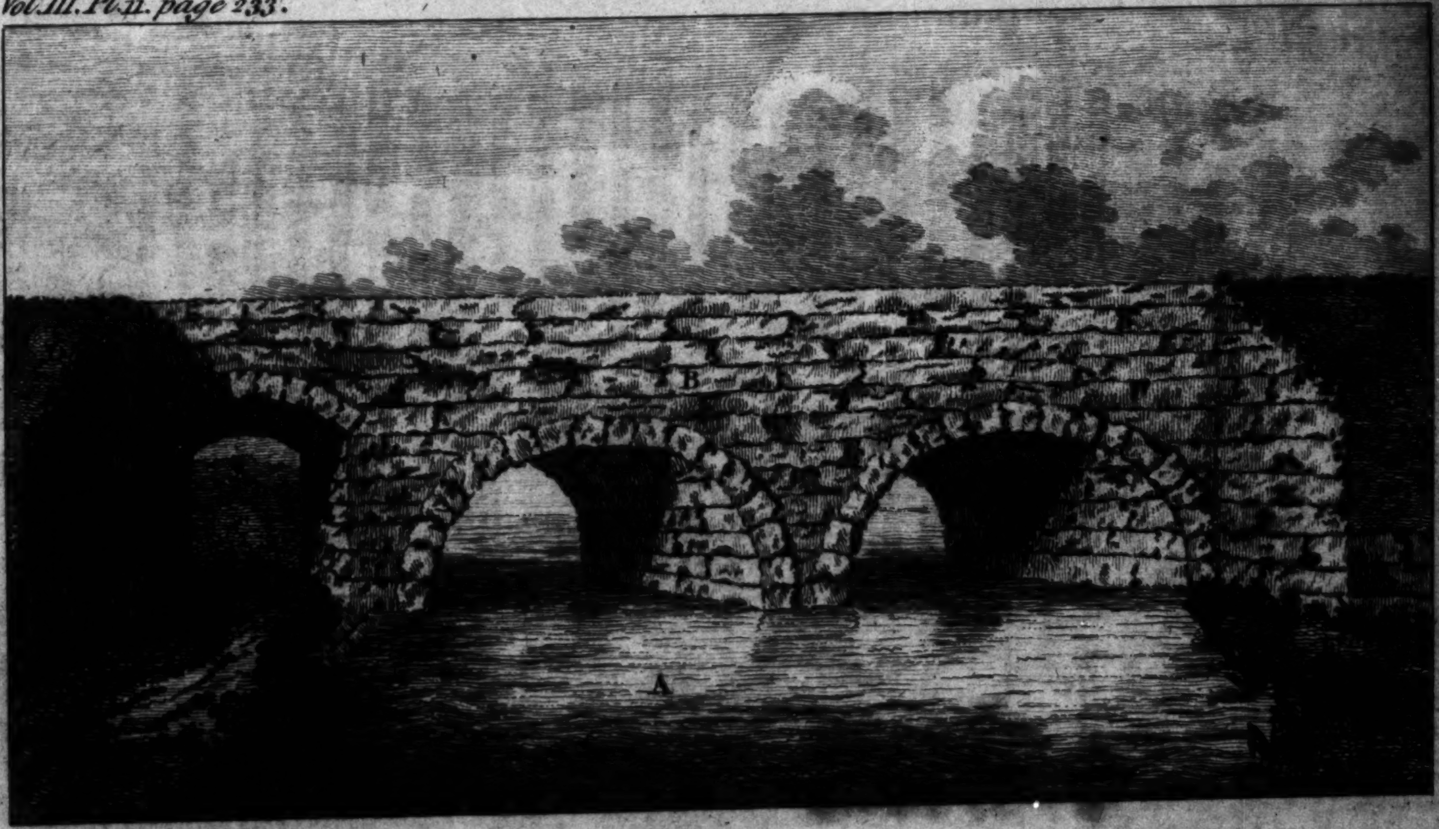

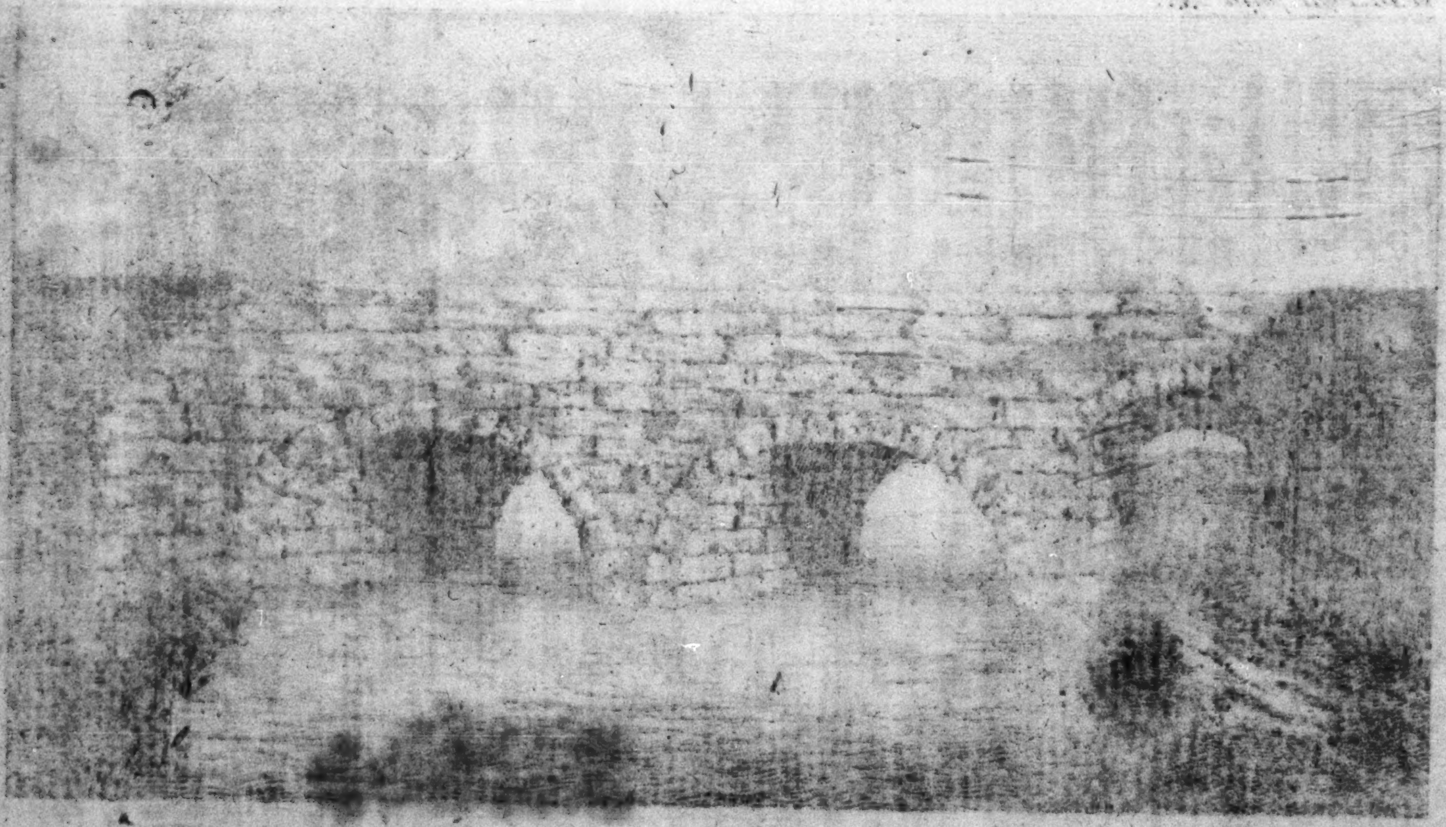

ing the water on a level. This was effected by making a vaſt caſe of timber for the whole work: Great piles of deal were fixed as a mound to keep the earth in a proper poſition to form the banks; and when they were raiſed, the piles removed on for anſwering the ſame work again, and the water brought forwards by degrees, to the aſtoniſhment of thoſe who pronounced the work impracticable *. It is carried over two brooks here, for which arches are turned.

At *Altringham Bridge* the Duke has a large warehouſe on the ſide of the canal, ſeveral ſtories high, for the convenience of ſtowing and lodging goods, in the trade that is carried on, on this part of the navigation: Alſo a wharf for ſelling coals, with cranes erected for loading and unloading boats: Here, likewiſe, his Grace's people burn charcoal.

Advancing with the canal, we come to *Dunham*, paſſing through a lock conſtructed upon the ſame principle as the canal-doors, ſo often mentioned. *Dunham* ſchool is ſeen upon the left; a plain and unornamented, but elegant front; as pleaſing, of the kind, as any one I remember to have ſeen. A little further, we came to the works then executing, which are in the nature of all in this great undertaking: The canal is here carried over two roads, and the river *Bollam*; and a great inequality in the ſurface of the country remedied by a ſyſtem of

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* This was an admirable contrivance of Mr. *Brindley*'s, whereby an immenſe expence was ſaved in the execution of this work, till then thought impracticable; but even this, though it ſucceeded ſo well, was too tedious and expenſive for this great Engineer. Caſſoons and locks are now diſuſed in breeching, and a much cheaper method contrived, by lines called Puddling, whereby the principal part of the work is executed by water; but as it is hoped we ſhall ſoon have ſuch works carrying on near *London*, it will be needleſs to deſcribe it here.

locks

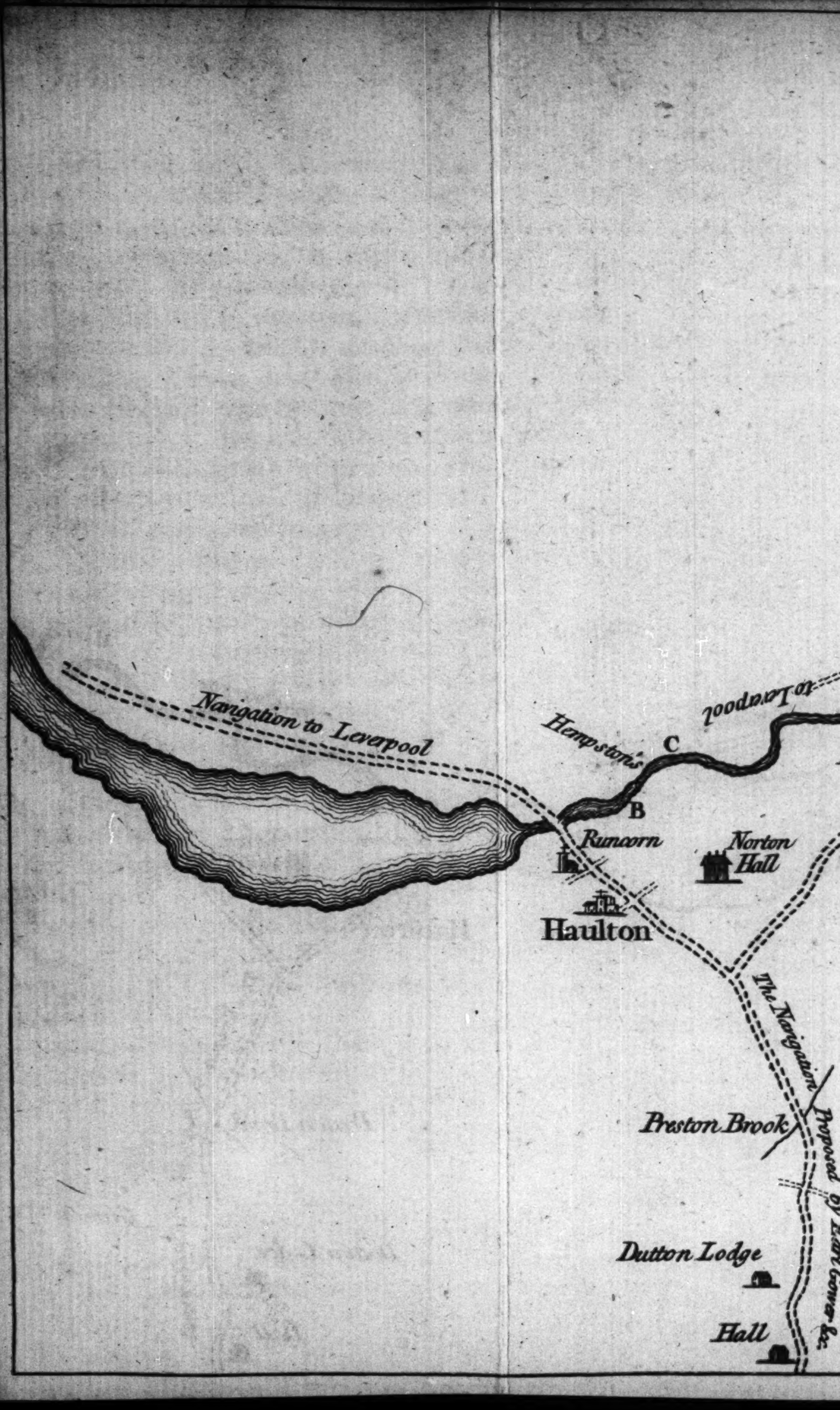
locks, of which there are eight, within a vaſt frame-work of timbers, in the diſtance of about thirty yards. When finiſhed, and the water navigated, all theſe locks will be paſſed by a gang of barges, in leſs than twenty minutes. The canal croſſes the roads and the river, on vaſt arches, in the ſame manner as already deſcribed and repreſented. The activity and ſpirit with which the workmen carry on their buſineſs, is very pleaſing; carpenters, ſmiths, maſons, labourers, boatmen, *&c. &c.* are all employed in great numbers, ſo that the works advance with great celerity. Here I obſerved two very large barges, with a houſe built in each, and a chimney in one: This is a floating blackſmith's forge and ſhop, with all ſorts of tools, *&c.* The other is a carpenter's ſhop; theſe are of excellent uſe in following the works as they advance; ſaving all the trouble and expence of repeated erections and removals.

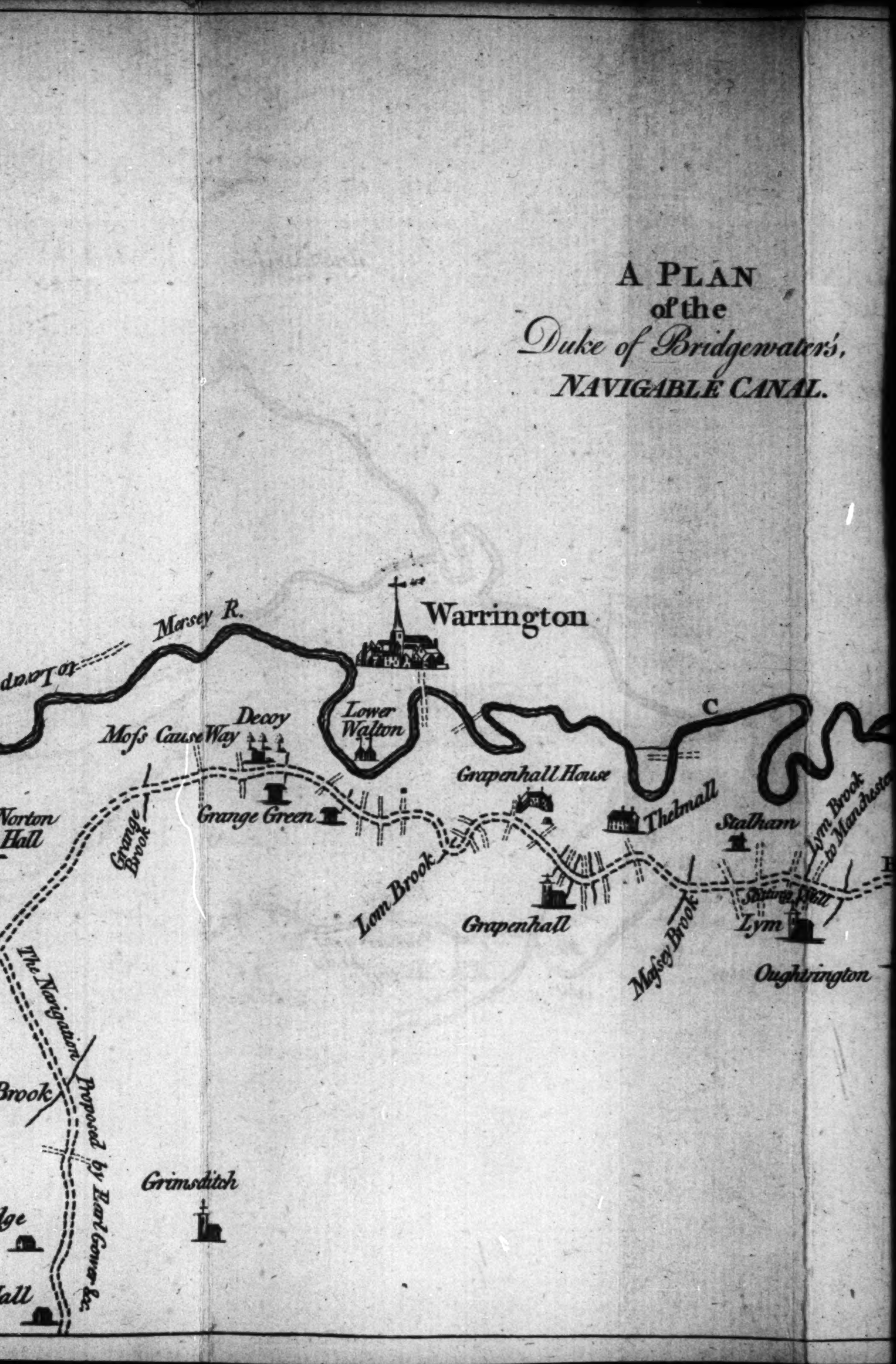
The works are alſo carrying on by near three hundred men, about two miles further; barges have been carried thither by land, and floated for the uſe of the workmen; but both parts of the canal will ſoon join, as the buſineſs goes on with ſo much ſpirit.

Another part of his Grace's deſign, and which he has an act to enable him to execute, is to extend a branch of his canal from *Sale Moor* to *Stockport*, but not yet begun: That place being a town of conſiderable manufacture and trade, further very conſiderable benefits may reaſonably be expected to accrue from the encreaſe of traffic on the canal thereby occaſioned. This intended branch is, like the reſt, marked in the annexed map, Plate XII, which delineates the whole country through which the navigation extends.

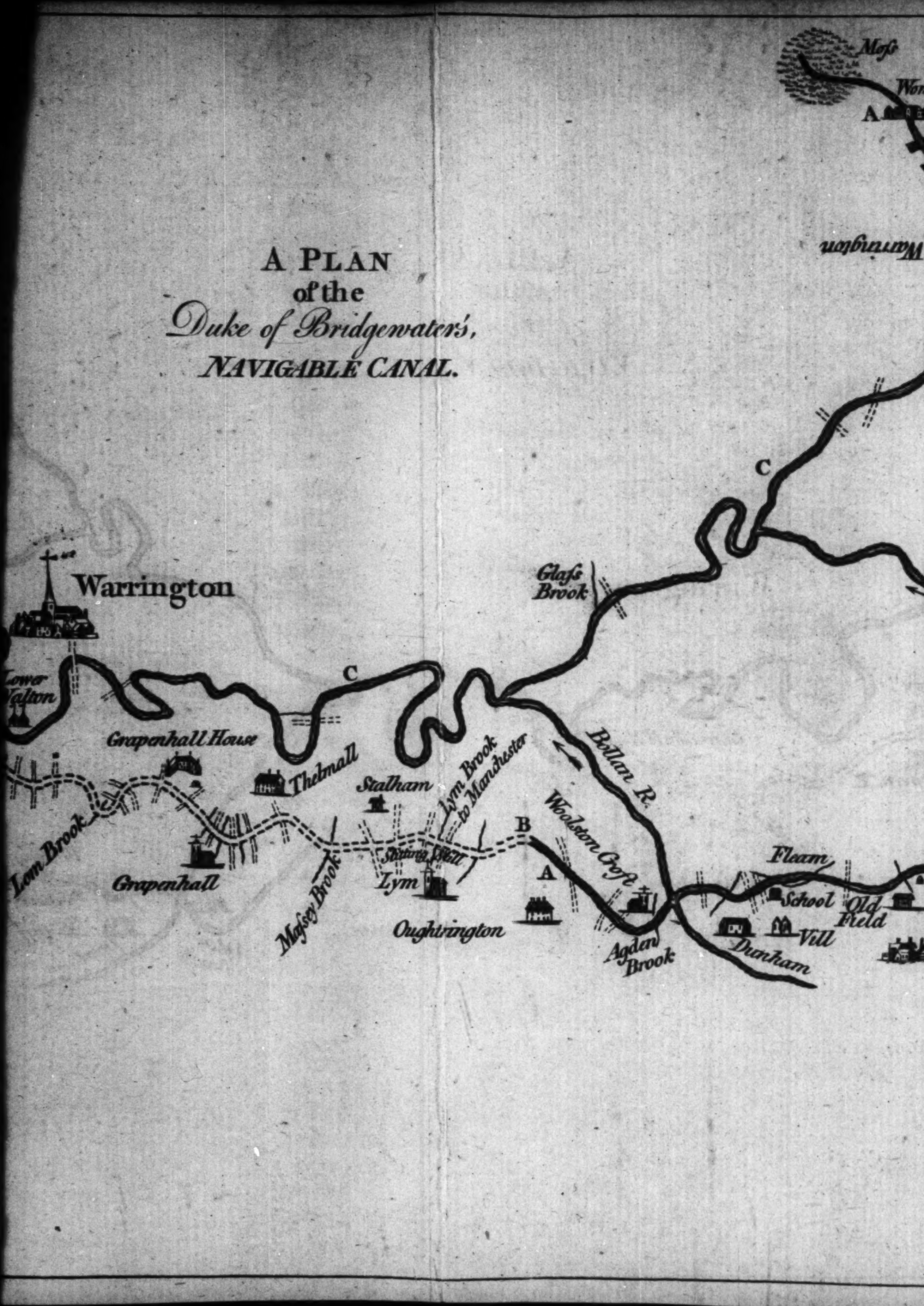
A, A, A. Is the Duke's navigation finiſhed.

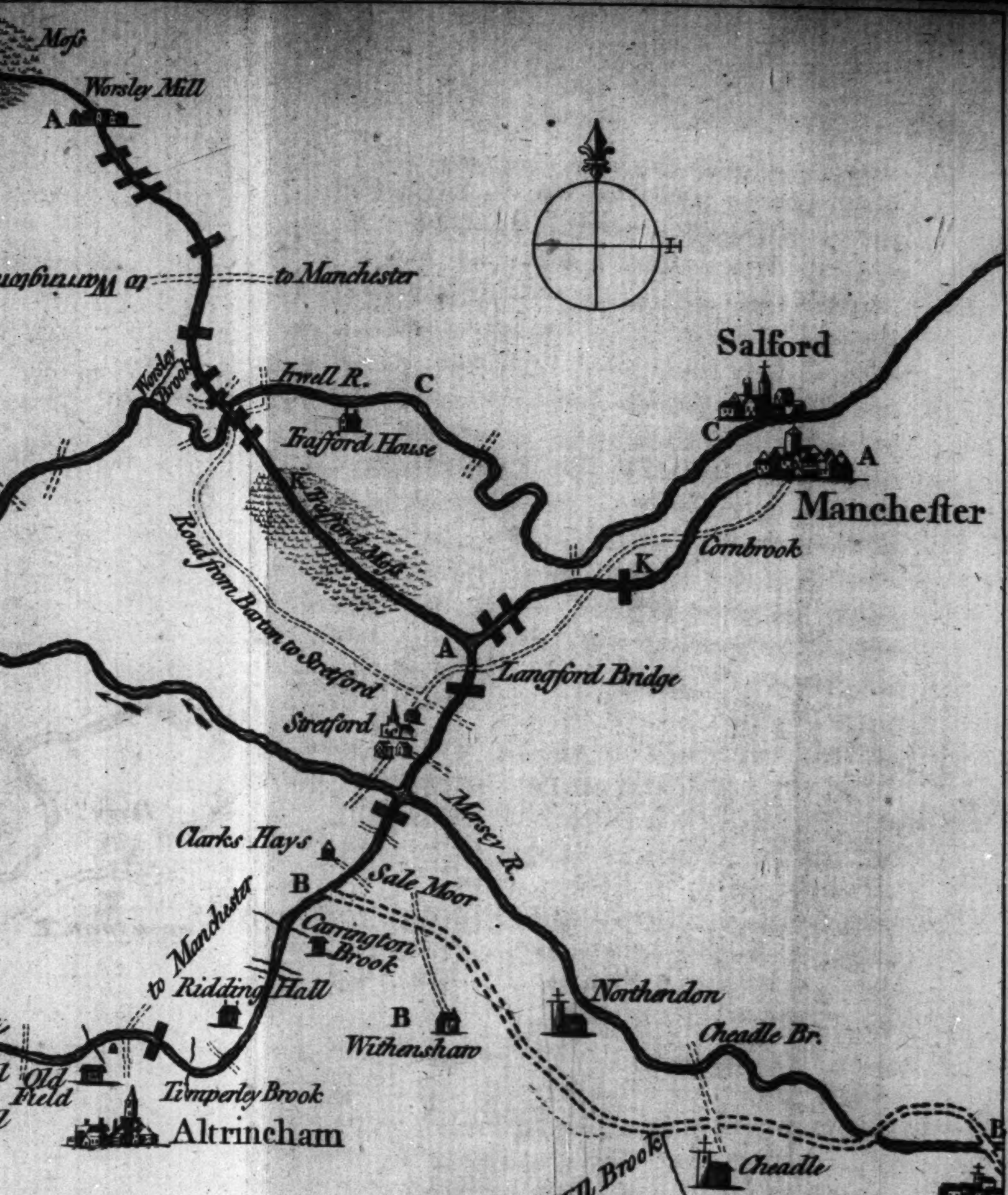
B, B, B. Ditto unfiniſhed.


Navigation to Leverpool
Hempston's
C
to Leverpool
B
Runcorn
Norton Hall
Haulton
The Navigation Proposed by Earl Gower &c.
Preston Brook
Dutton Lodge
Hall



A PLAN
# of the
Duke of Bridgewater's,
NAVIGABLE CANAL.




Moss
Worsley Mill
A
to Warringto
to Manchester
Worsley Brook
Irwell R.
C
Trafford House
K
Trafford Moss
Road from Barton to Stretford
A
Langford Bridge
Stretford
Salford
C
A
Mancheſter
Cornbrook
K
Clarks Hays
B
Sale Moor
Mersey R.
Carrington Brook
to Manchester
Ridding Hall
B
Withenshaw
Northendon
Cheadle Br.
Old Field
Timperley Brook
Altrincham
Mill Brook
Cheadle
B
Stockport
SCALE of MILES.
1
2
3
4
5

C, C, C. Courſe of the old navigation.

[] acroſs the canal—The canal-doors.

But here I ſhould add, that a ſcheme, much greater than any thing executed, is in contemplation, though not yet come before parliament. His Grace was firſt enabled to extend his canal to the *Hemp-ſtones*, (ſee the Map;) but my Lord *Gower*, and many other perſons, obtaining an act for a canal from the *Trent* to the *Merſey*, to communicate between the towns of *Hull* and *Liverpool*, the Duke of *Bridgewater* agreed with them (under authority of Parliament) to vary the courſe of his intended canal, and meet theirs half way, between *Preſton-brook* and *Runcorn*, and then the two canals, united, to be carried to the *Merſey* at *Runcorn*.

Since that Mr. *Brindley* has viewed the river at *Runcorn*, and is of opinion, that the navigation might be carried *over* it on an aqueduct, and then forwarded directly to *Liverpool*. And we may expect, in a few years, to hear that his Grace has completed his navigation this way, by reaching the *Merſey* at *Runcorn Gap*; after which, this canal will undoubtedly be the eaſieſt, cheapeſt, and beſt way of ſending goods of all kinds from and to *Liverpool* and *Mancheſter*.

It is to that period the Duke looks for a reimburſement of the immenſe ſums this navigation has and will coſt him: The benefit of water-carriage for his coals at *Worſley* to *Mancheſter*, *Altringham*, *&c.* is certainly a great advantage; but not near ſufficient to repay the expence of ſuch vaſt undertakings; but when two ſuch conſiderable trading and manufacturing towns as *Mancheſter* and *Liverpool* communicate, by means of this navigation, at a cheaper and eaſier rate than by the old one, there is no doubt but his Grace will meet with that profitable return his noble ſpirit ſo truly deſerves.

This ſcheme is a vaſt one, and worthy ſo bold and daring a genius. The river *Merſey*, at that place, is five hundred and ſixty yards wide; and at ſpring tides the water flows near eighteen feet perpendicular. The maſts of veſſels, which navigate the river itſelf, are ſaid to be ſeventy feet high; add to all this, that the river is ſometimes rough and boiſterous: It is planned, notwithſtanding theſe tremendous difficulties, to carry the canal acroſs the river. The greateſt undertaking (if executed) that ever yet was thought of, and will exceed the nobleſt works of the *Romans*, when maſters of the world; or the legendary tales even of *Semiramis* herſelf.

The excellency and utility of the plan are, however, indiſputable: If the canal was carried directly to the town of *Liverpool*, there would at once be a complete, eaſy, ſafe, and cheap navigation from that great ſea-port directly to *Mancheſter*, and all the other towns and places near which the canal goes. The preſent navigation is that of the river *Merſey*, or, in other words, an arm of the ſea for ſeveral miles, which is at beſt but an inſecure navigation for inland boats, not to ſay a dangerous one, and occaſions ſuch precautions of the expenſive kind, that the carriage of goods can never be half ſo cheap or regular as upon a canal. This river partakes, with others, of diſadvantages, to which canals are not ſubject, ſuch as tides, floods, working one way againſt a ſtream, &c. &c. from all which the new navigations are perfectly free; add to this, the old navigation here is cramped with ten times the number of locks, that the canal would be.

But ſomething ſure is due to the execution and poſſeſſion of works, which command the attention and admiration of all *Europe:* The number of foreigners who have viewed the Duke of *Bridgewater*'s preſent navigation, is ſurprizing; what would it be if his Grace was to extend it over a boiſterous arm of the ſea:—To exhibit a navigation afloat in the air, with ſhips of an hundred tons ſailing full maſted beneath it. What a ſplendid idea *!

Upon the whole, the uncommon ſpirit which actuated his Grace the Duke of *Bridgwater* in deſigning and executing ſuch noble works, can never be ſufficiently admired: At an age when moſt men aim only at pleaſure and diſſipation, to ſee him engaged in undertakings, that give employment and bread to thouſands; that tend ſo greatly to advance the agriculture, manufactures, and commerce, of an extenſive neighbourhood; in a word, that improve and adorn his country, is a ſight ſo very uncommon, and ſo great, that it muſt command our admiration. Nor was it leſs to his

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* In ſome of the controverſial writings, publiſhed on the propoſition of a navigation from *Hull* to *Liverpool*, the prejudiced, or rather intereſted people, who were ſtanch friends to the *old* navigations, and, by the by, ridiculed *canals*, in a manner which muſt now, while ſuch great ſucceſs attends them, turn, I think, to their ſhame, among other arguments aſſerted the ſufficiency of the navigation to *Liverpool* already exiſting; a ſtroke in one of their anſwerers is excellent:—" The delays " and inconveniencies render this (the old) navigation " ineffectual for the conveyance of the produce *even* of " the county of *Cheſter*; as far the moſt conſiderable " part of the *cheeſe* produced in that county is now car- " ried *by land*, *parallel* with the *whole length* of this " EXCELLENT navigation, to *Frodſham-bridge*, and " *Bank-quay*; from which place it is conveyed by flats " to *Liverpool*, there to be re-ſhipped for *London*, and " other markets; and SALT, the other *ſtaple* article of " this county, is ſent, in *great quantities*, all *by land car-* " *riage*, from *Northwich*, to *Mancheſter*, for the ſupply of " that town, and a very extenſive and populous neigh- " bourhood, notwithſtanding the preſent *navigable com-* " *munication* between thoſe places."

Grace's honour, that, in the execution of theſe ſpirited ſchemes, he had the penetration to diſcern the characters of mankind ſo much, as to fix on thoſe people who were formed by nature for the buſineſs; to draw forth latent merit; to bring from obſcurity one of the moſt uſeful genius's that any age can boaſt; to throw that genius at once into employment; to give a free ſcope to his bold ideas; to be unſparing of money in ſupporting them; and to keep him conſtantly in a ſituation of rendering his talents uſeful to his country; all prove that his Grace has a mind ſuperior to common prejudice; that he is one of thoſe truly great men, who have the ſoul to execute what they have the genius to plan. I remain, dear Sir, yours, very ſincerely.

Extracts from a Letter publiſhed in the LONDON MAGAZINE, *for* October, 1772, *by an unknown Author*. Page 473, &c.

SPEAKING of the *Leeds* Canal, he ſays, *Leeds* in *Yorkſhire* and *Liverpool*, a ſpace of above one hundred miles, through a moſt unlevel country, and where they have many difficulties to contend with, any one of which, a few years ago, would have been deemed inſuperable. Great, however, as they are, they are ſurmounted, and above twenty miles are finiſhed and navigable. The project of this canal is moſt ſignally uſeful to theſe parts of the world at preſent, and muſt remain ſo. It facilitates the tranſport of our colony produce to *Holland*, to the *Elbe*, the *Baltic*, as much as the canal now cutting from the *Clyde* to the *Forth*, through *Scotland*: A vaſt acquiſition to the trade of *Glaſgow*, and all *Scotland*, upon the decay of *Engliſh* commerce. But I do not repine at this: the riches of the empire will gradually flow to the ſeat of empire; yet, being an *Engliſhman*, the love of my country ſo far prevails, as to wiſh my fellow *Britons* the fruition of that commerce, to which the diligence and ability of our countryman has opened a door.

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Speaking of the Canal from *Coventry* to *Oxford*, he ſays, The ground is opened for ſeveral miles towards this place; but whence it ariſes I know not: the works ſeem at a ſtand; and as great a friend as I am to theſe undertakings, here I wiſh it may ſtop, *till the citizens of* London *have time to bethink themſelves.*

I know it is propoſed to improve the navigation of the river *Thames* from *Oxford* to *London.* That it may be amended, there ſeems not a doubt; and the length may be ſhortened by cuts, where the river takes a large circuit. But, with all the expence that can be laid out upon it, and all the improvements by the united ſkill of the ſeveral able engineers, of whom the *Britiſh* nation is now in poſſeſſion, it is impoſſible to make theſe amendments equal to a canal, conducted in as ſtraight a line as the ground will permit, from *London* to *Coventry*, without ever coming near the *Thames*, or near *Oxford.*

* * * *

The benefits reſulting from the communication I propoſe, with the principal northern canals, are innumerable; but I will firſt ſtate a few diſadvantages that will ariſe to the capital, if ſuch a communication is not ſet on foot.

Briſtol, *Liverpool*, and *Hull*, will ſupply all the midland parts of *England*, within fifty miles of *London*, perhaps thirty, with all heavy goods, as grocery, wines, iron ware, and many other articles, at a much cheaper rate than *London* can afford them, on account of land carriage inſtead of water. Theſe ports will be ſupplied with all ſorts of manufactures for exportation, on much better terms, becauſe the navigations either paſs through, or on the confines of the manufacturing countries. By theſe means the inland trade of the city will daily diminiſh; and their exports muſt likewiſe diminiſh, becauſe all their trading neighbours can purchaſe their goods on better terms, by reaſon of the leſs expenſive carriage.

The good effects of a canal would be, that it would bring all kinds of proviſions to the capital at a much cheaper rate, and in a much better condition, than by land-carriage. Even hay would

be

be brought with eaſe from greater diſtances than can be ſuſpected, on eaſy terms. Inſtead of being ſupplied with this article from the limited circle of ten or fifteen miles, it might be brought fifty at a much leſs expence. Corn, from the interior parts of the kingdom, would be brought to *London*, inſtead of finding its way to the out-ports; and it would come ſo much the cheaper, as the boats would be ſure of back carriage. Coal, lime, ſtone, timber, deals, at leaſt would ſupply immenſe traffic, and all other kinds of heavy goods. Even ſheep, calves, hogs, nay oxen, might be thus conveyed, at a trifling expence, and in fine condition for immediate uſe. The manufactures of *Birmingham*, *Coventry*, *Mancheſter*, every part of the North, would thus find a ſafe and ſpeedy conveyance. The ſavings of inſurance, in time of war, would be ſufficient almoſt to complete ſuch a navigation.

The Duke of *Bridgewater* has eſtabliſhed regular paſſage-boats from *Mancheſter* to within two miles of *Warrington* and other places: people find the benefit of them. Forty, fifty, or ſixty people, are conveyed above twenty miles for a ſhilling a piece, in a ſhorter time than they can travel even in a carriage by land. They are allowed to carry with them a certain quantity of goods, at the ſame expence—a prodigious benefit this to the public, and to individuals. This will be the caſe upon all the canals, and would be particularly ſo in the neighbourhood of *London*. Inſtead of ſelling the produce of the farm to higlers, and they to gain a profit upon the conſumers, theſe middle people would ceaſe; the farmers themſelves, along the canals, would bring their produce to market. But the advantages are, as I ſaid before, innumerable.

From a ſuperficial view of the country, the ſcheme appears extremely practicable; and, as I have not the leaſt doubt but it would be alike advantageous

vantageous to the proprietors and the public, if a number of judicious perſons, men of property and character, would embark in ſuch an undertaking, I have not the leaſt doubt of its ſucceſs; at leaſt I ſhould chearfully riſque a part of my property in ſuch an undertaking. If a trading town, like *Leeds*, with the aid of ſome gentlemen in the neighbouring counties, have had the reſolution to engage in a navigation, under ſo many difficulties, through an extent of country of upwards of 108 miles long, cannot there be found in the city of *London* perſons of property ſufficient to accompliſh the propoſed deſign? I am ſatisfied, there is only wanted a beginning; and I ſhould be glad if this might entice ſome abler hand to propoſe it to the public with effect, as I am as fully perſuaded of its practicability and advantage, as I am of the loſs which the trading part of the city of *London* muſt ſuſtain, if they do not endeavour to ſecure to themſelves a cheaper method of conveying goods of all kinds to *London*, than either by the uncertainties of the beſt river navigation that can be made, or by land-carriage.

The benefits reſulting from theſe navigations to the country are immenſe: perſons are conveyed with great diſpatch, perfect eaſe and ſafety, from place to place, at a trifling expence; goods of all kinds are with the utmoſt certainty landed at any place within the reach of the navigation, upon the moſt moderate terms; the labour of many hundred horſes is already ſaved, I might ſay ſome thouſands; *the value of the lands is every where increaſing along the borders of theſe canals, as the produce can be ſent much cheaper to market, and manure of many kinds brought where wanted with leſs difficulty.* At *Runcorn* the Duke of *Bridgewater* is executing a moſt maſterly performance. In a very ſhort ſpace, he is obliged to conquer, by means of numerous locks,

locks, a deſcent of about eighty feet. The contrivance to do this by means of locks is amazing: the ſaving of water, the expedition of the deſcent, the perpetuity of the work, have all been taken into conſideration, and moſt judiciouſly provided for: to deſcribe the ſeveral circumſtances would require a volume.

Speaking of the *Staffordſhire* Canal, at page 476, he ſays,—This canal forms a junction with the *Trent* and the *Merſey*; or, in other expreſſions, a communication between *Hull* in *Yorkſhire*, and *Liverpool* in *Lancaſhire*, running through *Nottinghamſhire*, *Staffordſhire*, and *Cheſhire*, and receives it its courſe a communication with the *Severn*; ſo that *Briſtol, Liverpool, and Hull, will ſoon enjoy the benefit of an inland intercourſe*, and by which commodities of all kinds can be conveyed with ſafety, expedition, and certainty, with reſpect to time, at all ſeaſons, except in extreme rigorous froſts. For, as a capital point in theſe undertakings is to provide, in the drieſt ſeaſons, a ſufficient quantity of water to anſwer the purpoſes of locks, exhalation, and other caſual waſtes; to take care likewiſe, that in the wetteſt ſeaſons the ſuperfluous water ſhall every where have free vent: ſo there being no current, veſſels paſs one way or the other with equal ſpeed, and the navigators can tell to an hour, at what time they ſhall arrive at the place of their deſtination.

Mancheſter, *Coventry*, *Birmingham*, *Liverpool*, *Hull*, *Briſtol*, and all the dependent manufacturing towns, will thus, in the ſpace of a very few years, have a ſafe, cheap, certain communication with each other, unaffected by war, free from inſurance or privateers. What an amazing benefit this to the ſea ports!—And at whoſe immediate loſs? *The port of London.*

FINIS.

DIRECTIONS *for placing the* PLATES.

The reference upon the plate alludes to the original work, ſo it will be neceſſary to place
Plate IV. of 252 fronting page 6, of this book:
Plate VII. of 219 fronting —— 8, ditto.
Plate VIII. of 222 fronting —— 10, ditto.
Plate VII. of 273 fronting —— 12, ditto.
Plate VIII. of 278 fronting —— 16, ditto.
Plate XI. of 233 fronting —— 18, ditto.
Plate X. of 286 fronting —— 20, ditto.